Semight

S3022F

Dual-Channel Precision Source Meter

Version 1.5

Leader in optical communication and semiconductor high-end test instruments

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Product Description

The S3022F precision source meter is compact and cost-effective bench-top Source/Measure Units (SMUs) with the capability to source and measure both voltage and current. These capabilities make the S3022F ideal for a wide variety of IV (current versus voltage) measurement tasks that require both high resolution and accuracy.

The S3022F provides best-in-class performance for a modest price. They have broad voltage (±200 V) and current (± 3 A DC and ±10 A pulsed) sourcing capability, excellent precision (minimum 100 fA/100 nV sourcing and measuring resolution) and possess a superior color LCD graphical user interface (GUI). In addition, several task-based viewing modes dramatically improve productivity for test, debug and characterization.

The S3022F offers unmatched measurement throughput and supports conventional SMU SCPI commands for easy test code migration. These features improve efficiency and lower the cost of ownership when integrating the SMUs into systems for production test.

Key Features

Feature	Benefit
Integrated 4-quadrant sourcing and measuring capabilities	Easily and accurately measure current and voltage using a single instrument without the need to manually change any connections
Measurement range: ±200 V, ±3 A (DC), ±10 A (pulsed)	A Single SMU product covers both high voltage and high current measurement needs, allowing for more standardization and simplifying inventory and support concerns
Source and measurement resolution down to 100 fA and 100 nV	Can make low-level measurements using a low-cost bench-top SMU that were previously only possible using a more expensive semiconductor device analyzer
Fast measurement	Up to 1M ADC sampling rate , NPLC and sampling rate optional setting
User-friendly front panel GUI with 4.3 inch resistive touchscreen supports both graphical and numerical view modes	Can quickly and easily perform measurements and display data on the front panel, thereby greatly speeding up interactive test, characterization and debug operations
Free quick V/I control software	Can make measurements remotely from a PC without the need to program
Supports both conventional and default SCPI commands	Conventional SCPI commands provide some compatibility with older SMU code (such as Keithley 2400 series) to minimize code conversion work
Synchronization	Highspeed/ low - delay multi-channel synchronization with hardware technology
Digital I/O	Flexibly configured High-speed Digital I/O, support threshold value triggering, so as to realize efficient interaction between output measured values and user system
Small form factor with USB2.0, LAN	Easy integration into rack and stack systems

Applications

The S3022F has a broad application range that spans uses from R&D and education to industrial development, production test and automated manufacturing. Moreover, they work equally well as either standalone or system components.

Testing semiconductors, discrete and passive components

- Diodes, laser diodes, LEDs
- Photodetectors, sensors
- Field effect transistors (FETs), bipolar junction transistors (BJTs)
- ICs (analog ICs, RFICs, MMICs, etc)
- Resistor, varistor, thermistors, switches

Testing precision electronics and green energy devices

- Photovoltaic cells
- Power transistors, power devices
- Battery
- Automotive
- Medical instruments
- Power and DC bias source for circuit test

Research and education

- New material investigations
- Nano devices characterization (e.g. CNT)
- Giant magnetic resistance (GMR)
- Organic devices
- Any precise voltage/current source and measurement Specification

Technical Specification

Temperature :23 °C ± 5 °C

Humidity :30% to 70% RH

Calibration period:1 Year

Measurement speed: 1PLC (power line cycle)

After 60 minutes warm-up, ambient temperature changes less than ± 3 °C

Voltage source specifications

Voltage programming accuracy	Range	Programming resolution	Accuracy (1 Year) ± (% reading+ offset)	Typical Noise (RMS) 0.1 Hz-10Hz
	±200 V	1mV	0.02%+40 mV	600 μV
	±20 V	100 μV	0.02%+5 mV	100 μV
	±6 V	10 μV	0.02%+500 μV	4 μV
	±200 mV	1 uV	0.02%+200 μV	2 μV
Temperature coefficient	±(0.15 × accuracy)/°C (0℃-18℃,28℃-50℃)			
Maximum output power	30W: ±20V@1.5A, ±200V@0.1A;18W: ±6 V@3A			
Settling time	<800us (typical)			
Overshoot	<±0.1% (Typical.Normal.Step is 10 % to 90 % range, full range, resistive load)			
Noise 10Hz-20MHz	6V voltage source，3A resistive load，<3mV RMS			

Current source specifications

	Range	Programming resolution	Accuracy (1 Year) ± (% reading+ offset)	*Typical Noise (RMS) 0.1 Hz-10Hz*
Current programming accuracy	±10 A[1]	50 μA	0.4% + 40 mA	*NA*
	±3 A	20 μA	0.05% + 5 mA	*10 μA*
	±1.5A	5 μA	0.02% + 500 *μ*A	*3 μA*
	±150 mA	500 nA	0.02% + 25 μA	*800 nA*
	±15 mA	50 nA	0.02% + 2.5 μA	*100 nA*
	±1.5 mA	5 nA	0.02% + 150 nA	*20 nA*
	±150 μA	500 pA	0.02% + 25 nA	*200 pA*
	±15 μA	50 pA	0.02% + 3 nA	*75 pA*
	±1.5 μA	5 pA	0.03% + 600 pA	*50 pA*
	±150 nA	500 fA	0.05% + 300 pA	*10 pA*
Temperature coefficient	±(0.15 × accuracy)/°C (0℃-18℃,28℃-50℃)			
Maximum output power	30W: ±20V@1.5A, ±200V@0.1A;18W: ±6 V@3A			
Settling time	*<500us (typical)*			
Overshoot	<±0.1% (Typical.Normal.Step is 10 % to 90 % range, full range, resistive load)			

1，10 A range is available only for pulse mode, accuracy specifications for 10 A range are typical.

Voltage measurement specifications

	Range	Measurement resolution	Accuracy (1 Year) ± (% reading+ offset)
Voltage measurement accuracy	±200 V	100 μV	0.02% + 40 mV
	±20 V	10 uV	0.02% + 5 mV
	±6 V	1 uV	0.02% + 500 uV
	±200mV	100 nV	0.02% + 200 μV
Temperature coefficient	±(0.15 × accuracy)/°C (0℃-18℃,28℃-50℃)		

Current measurement specifications

	Range	Measurement resolution	Accuracy (1 Year) ± (% reading+ offset)
Current measurement accuracy	±10 A[1]	10 μA	0.4% + 25 mA
	±3 A	10 μA	0.05% + 5 mA
	±1.5A	1 μA	0.02% + 500 μA
	±150 mA	100 nA	0.02% + 25 μA
	±15 mA	10 nA	0.02% +2 μA
	±1.5 mA	1 nA	0.02% + 150 nA
	±150 μA	100 pA	0.02% + 20 nA
	±15 μA	10 pA	0.02% +3 nA
	±1.5 μA[2]	1 pA	0.03% + 600 pA

	±150 nA[2]	100fA	0.05% + 300 pA
Temperature coefficient	±(0.15 × accuracy)/°C (0℃-18℃,28℃-50℃)		

1，10 A range is available only for pulse mode, accuracy specifications for 10 A range are typical.

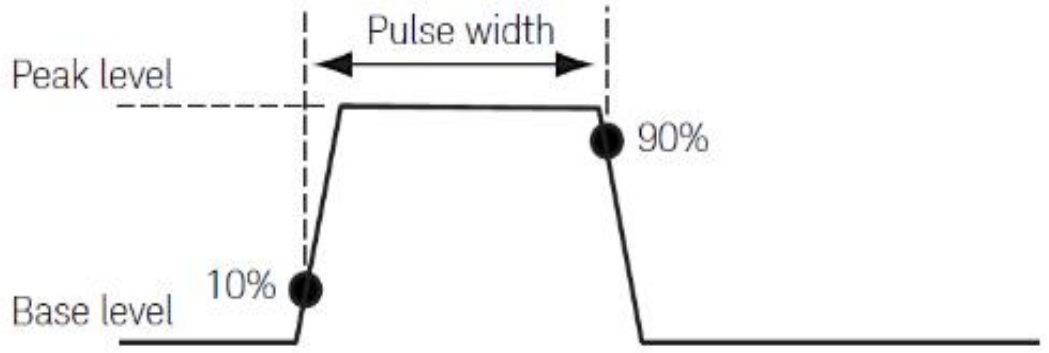
2，Low Current Measurements，Triaxial Cable is recommended to connect: Force Hi connect to core cable, Guard connects to inner shield, outer shield connects to protective ground, Force Lo connect to core cable, inner shield not connect, and outer shield connect to protective ground. Triaxial Cable rated insulation voltage is not less than 250V。

Resistance measurement specifications (4W)

	Range	Measurement resolution	Test current	Accuracy (1 Year) ± (% reading+ offset)
Resistance measurement accuracy	1 Ω	1 uΩ	1 A	0.09% + 0.5 mΩ
	10 Ω	10 uΩ	100 mA	0.065% + 5 mΩ
	100 Ω	100 uΩ	10 mA	0.065% + 50 mΩ
	1 KΩ	1 mΩ	1 mA	0.055% + 500 mΩ
	10 KΩ	10 mΩ	100 uA	0.065% + 5 Ω
	100 KΩ	100 mΩ	10 uA	0.07% + 50 Ω
	1 MΩ	1 Ω	1 uA	0.05% + 500 Ω
	10 MΩ	10 Ω	0.1 uA	0.65% + 5KΩ
	100 MΩ	100 Ω	0.05 uA	1.27% + 10 KΩ
Temperature coefficient	±(0.15 × accuracy)/°C (0℃-18℃,28℃-50℃)			
Source I mode, manual Ohm measurement (4-wire)	Total error = Vmeas/Isrc = R reading x (gain error % of V range + gain error % of I range + offset error of I source range/Isrc value %) + (offset error of V measure range/Isrc value) Example：I source value=1A at 1A range V measure range=1V range Total error(% reading + offset) = (0.02%+0.02%+500uA/1A) +(500uV/1A) =0.09%+0.5mΩ			

Pulse source specifications (4W)

Minimum programmable pulse width	100μs
Pulse width programming resolution	1μs
Pulse width programming accuracy	±10μs
Pulse width jitter	2μs
Pulse width definition	The time from 10 % leading to 90 % trailing edge as follows



Item	Maximums	Maximum pulse width	Maximum duty cycle
1	0.15A/200V	DC,no limit	100%
2	1.5A/20V	DC,no limit	100%
3	3A/6V	DC,no limit	100%
4	3A/20V	1mS	10%
5	10A/6V	1mS	10%

Typical Pulse Performance (4W)

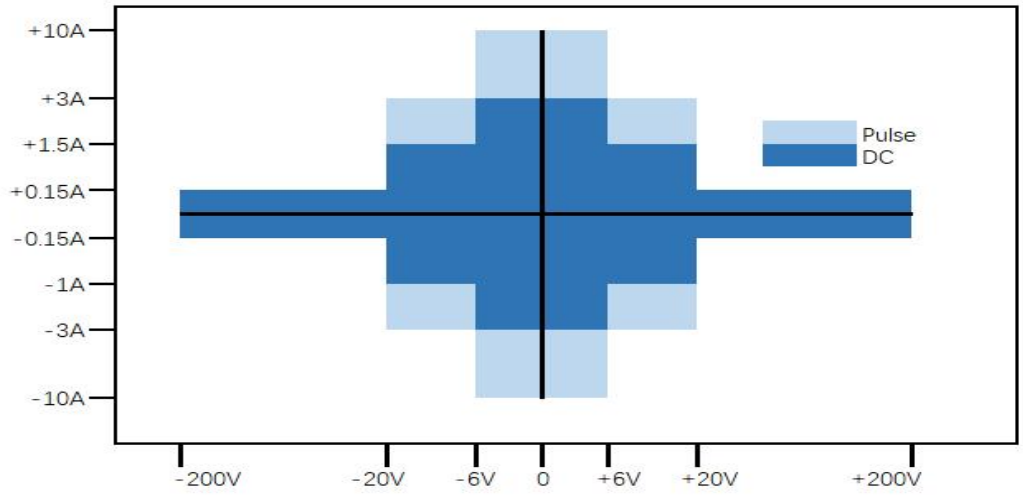
Source	range	Typical rise time [1,3]	Typical Settling Time[2,3]	Test load
Voltage	200 V	600 μS	1.5 mS	No load
	20 V	200 μS	360 μS	No load
	6 V	160 μS	300 μS	No load
Current	10 A	140 μS	320 μS	Full load
	3 A	120 μS	280 μS	Full load
	1.5 A	120 μS	280 μS	Full load
	150 mA	120 μS	280 μS	Full load
	15 mA	120 μS	280 μS	Full load
	1.5 mA	120 μS	280 μS	Full load

1, Leading edge, the time from 10 % leading to 90 % leading

2，The time required from Pulse out 0 to reach within 1 % of final value

3, Pulse current source base 6V voltage range and 105% range limit

I-V Out capability



Typical output settling time

Source	Range	Output settling time			Condition
		Fast [1,2]	Normal [1]	Slow[1]	
Voltage	200V	<1.3mS	<1.5mS	<2.5ms	Time required to reach within 0.1 % of final value at open load condition. Step is 10 % to 90 % range
	20V	<300μS	<360μS	<1ms	
	6V	<150μS	<250μS	<1ms	
	200mV	<200μS	<250μS	<1ms	
Current	3A	<200μS	<280μS	<1.2ms	Time required to reach within 0.1 % (0.3 % for 3 A range) of final value at short condition. Step is 10 % to 90 % range, Pulse current source base 6V voltage range and 105% range limit
	1.5A	<200μS	<280μS	<1.2ms	
	150mA	<200μS	<280μS	<1.2ms	
	15mA	<200μS	<280μS	<1.2ms	
	1.5mA	<200μS	<280μS	<1.2ms	
	150μA	<250uS	<300uS	<1.2ms	
	15μA	<250uS	<1.2mS	<2ms	
	1.5uA	<600uS	<1.2mS	<5mS	
	150nA	<600uS	<5mS	<12mS	

1,Output transition speed：Fast,Normal,Slow。

2, Slow mode is recommended for overshoot sensitive equipment, Fast mode may have overshoot on output in some condition

Sampling rate and NPLC setting

Setting	Range
NPLC	0.00005PLC ~ 10PLC
Sampling Rate	5sps ~ 1Msps

Derating accuracy with PLC setting< 1 PLC

Add % of range using the following table for measurement with PLC < 1

PLC	Range						
	200mV	6V	20V to200V	150nA to 1.5uA	15uA	150uA to 150mA	1.5A to 3A
0.1	0.02%	0.01%	0.01%	0.02%	0.01%	0.01%	0.01
0.01	0.3%	0.03%	0.02%	0.2%	0.04%	0.02%	0.02%
0.001	3.2%	0.4%	0.1%	2.5%	0.4%	0.03%	0.03%

Supplemental characteristics

Sensing Modes	2-wire or 4-wire (Remote-sensing) connections
Maximum sense lead resistance:	1 kΩ for rated accuracy
2W internal voltage drop	<60mV/A
Max voltage between High Force and High Sense	2V
Maximum output voltage in output connector	>range 105% (200V range>202V)
DC floating voltage	Max ±250 V DC between low force and chassis ground
Sweep	Sweep step time: from 20uS to 16S, Max:64K point
Auto range	Support, turn off output is recommended for overshoot sensitive equipment before range change
Source delay	Support, It is recommended that users set appropriate source delay to obtain higher accuracy
Over temperature protection	The output will be turned off (also disable operation) when the SMU internal temperature is detected higher than 85 degrees. When the temperature returns to less than 65 degrees, operation recover
Over voltage protection	Turn off output when output voltage great than OVP setting value, recover operation after power reset, Accuracy: ±(1%Setting+500mV)
Other abnormal protection	Power reset, recover operation or hardware damage

Communication port

LAN		100BASE-T / 10BASE-T
USB		USB 2.0 HOST (front)
		USB 2.0 DEVICE (back)
Digital I/O DB9 MAX input voltage: 5.25V Min input voltage: -0.25V Min logic H input voltage: 2.1V Max logic L input voltage :	Pin5	GND
	Pin6	IO1 CH1 digital I/O, Synchronous signal input (single/dual channel Synchronous mode)
	Pin7	IO2, CH1 digital I/O, Synchronous signal output (single channel Synchronous mode)

0.7V， Max source current：2mA Max sink current：-50mA	Pin8	IO3，CH2 digital I/O，Synchronous signal output（dual channel Synchronous mode），Synchronous signal input（single channel Synchronous mode）
	Pin9	IO4，CH2 digital I/O，single channel Synchronous mode，CH2 Synchronous signal output

Environmental specifications

Environment	For use in indoor facilities
Operating	0 °C to +50 °C, 30 % to 70 % non-condensing
Storage	-30 °C to 70 °C, 10 % to 90 % non-condensing
Altitude	Operating: 0 m to 2000 m, Storage: 0 m to 4600 m
Power	LINE：100-240VAC，50/60Hz，250W FUSE：T3.15AL 250 VAC
Warm-up	1 hour
Dimensions	429 × 441 × 112.5mm (with foot pad/handle/ rotary Knob)
Weight	Net weight 7.5 kg

Front Panel

Display	4.3” TFT color display (480x272), Resistive touchscreen
Hardkeys	Trigger,Home,Enter,Cancel，power on, output on/off,rotary Knob
Softkeys	LCD Mapping function keys
Connectivity	USB Host，output，ground

Rear panel

Connectivity	LAN, DB9, USB device,AC socket, Ground

Ordering information

Power cable，USB cable，quick reference，U disk（including PDF manuals, quick I/V Measurement Software and drivers）

Model number	
S3022F	Dual Channel Precision Source Meter, pulser

Contact us

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About Semight Instruments

Semight Instruments is a leading provider of global high-end test instrument and equipment. The company provides products and service to the development, fabrication and service of high-speed communication, optical chip and semiconductor testing fields. Semight's flagship testing instrument includes high-speed bit error ratio tester, network analyzer, broadband sampling oscilloscope, high-precision wavelength meter, optical spectrum analyzer, and digital Source Measure Unit. In addition, the company delivers optoelectronic hybrid ATE, laser chip burn-in system, laser chip tester, silicon photonics wafer tester, power chip tester, wafer level burn-in system, semiconductor parametric test system to domestic and international customers.

Semight Instruments adheres to the customer-centric, employee-based, innovation-driven, and subtle and broad corporate culture, and continues to provide customer trusted, cost-effective and high-performance products and service.

Visit www.semight.com for more information.

*Product specifications and descriptions in this article can be changed without notice